Calculus I — Russell Brown
Exam 2 — 19 October 1999

Answer all of the following questions. Use the answer sheets provided. Additional sheets are available if necessary. No books or notes may be used. You may use a calculator. When answering these questions, please be sure to 1) check answers when possible, 2) clearly indicate your answer and the reasoning used to arrive at that answer *(unsupported answers may receive NO credit)*, and 3) label all variables and equations.

Name ______________________

Section ___________

Question	Score	Total
1		10
2		10
3		10
4		30
5		10
6		10
7		10
8		10
Total		100

1. State the definition of the derivative. (The answer to this question is not “the slope of the tangent line”.)

2. Use the definition of the derivative to compute the derivative of

$$f(x) = \frac{1}{x}.$$

3. State and prove the product rule. Be sure to give the hypotheses and the conclusion in the statement of the product rule.

4. Compute the following derivatives.

(a) $\frac{d}{dx}2x^3 + 4x$

(b) $\frac{d}{dx}\frac{1}{x^2+1}$

(c) $\frac{d}{dx}\sin(x^2)$

(d) $\frac{d}{dx}\sqrt{x^2+1}$

(e) $\frac{d^3}{dx^3}\frac{1}{x+1}$

(f) $\frac{d}{dx}\sin(x)\cos(2x)$

5. A hiker throws a soccer ball up from a cliff at Raven's Run and 3 seconds later the ball lands in the dry river bed of the Kentucky River, 84 feet below the cliff. Recall that $h(t) = h_0 + v_0 t - 16t^2$.

   (a) Find the initial velocity of the soccer ball.

   (b) Give the height of the soccer ball above the cliff as a function of time. For your answer to be complete, you must give the position which you choose to correspond to a height of zero.

   (c) What is the maximum height of the soccer ball?

6. Find the tangent line to the curve defined by

$$4x^2 + xy^2 = -2$$

at the point where $x = -2$ and $y < 0$.

7. Suppose a light source is 50 feet from a wall and is rotating at an angular velocity of 5 radians per minute. How fast is the light beam moving along the wall at the instant when it is 25 feet away from the point on the wall opposite the light source?

8. Use the tangent line approximation to $\sqrt{x}$ at $x = 400$ to approximate $\sqrt{403}$.